

Science, Pseudo-Science, and Just Plain Bullshit

The last part of the title of this paper was inspired by *On Bullshit*, a recent book by Harry Frankfurt, Professor of Philosophy Emeritus at Princeton University. In his little book Professor Frankfurt discusses the increasing production of *bullshit* in today's society and observes that it occurs "...whenever a person's obligations or opportunities to speak about some topic exceed his knowledge of the facts that are relevant to that topic" (p. 63). This plus the lack of commitment to determine what is true and what is false results in the production of "sincere bullshit."

Science education has not escaped the trend in today's society to produce sincere bullshit. Unlike science which is limited by the reality of Nature and the requirement that observations and experiments must be replicable, science education seems to be under no such restrictions. Research in science education, like educational research in general, has become less concerned with factual correctness and more concerned with political correctness. Just as the news media became more concerned with ratings and less concerned with real news in the 1980s, educational research became more concerned with political correctness and less concerned with producing solid, replicable findings. This trend toward the relativism and obscurantism of post-modernism and away from the scientific ideal of a search for truth based on reason and solid evidence continues today. An example of the obscure writings of a leader (Gilles Deleuze) of the post-modern movement is exposed by Richard Dawkins in his book *A Devil's Chaplain*:

"In the first place, singularities-events correspond to heterogeneous series which are organized into a system which is neither stable nor unstable, but rather 'metastable', endowed with a potential energy wherein the differences between series are distributed ... In the second place, singularities possess a process of auto-unification, always mobile and displaced to the extent that a paradoxical element traverses the series and makes them resonate, enveloping the corresponding singular points in a single aleatory point and all the emissions, all dice throws, in a single cast." (p. 47)

Pseudo-sciences like astrology, creation science/intelligent design, Freudian psychotherapy, phrenology, sublaxation chiropractic, and hundreds of similar scams cover themselves with the banner of science while trying to convince people to give up their time and money in return for promises of a better life on Earth or in the hereafter. Without scientific habits of mind that include an understanding of the many forms of pseudo-science practiced by scam artists, people are willing to believe that for which there is little or no real evidence. It is not enough to know the facts of science or even to have knowledge of the nature of science to be considered scientifically literate. Scientific literacy must include the ability to recognize pseudo-science in its various forms in society in order for citizens to be safe from the many "...dogmatists, flimflam artists, and purveyors of simple solutions to complex problems" (AAAS, 1989, *Science for All Americans*, p. vi). It is within this context of limiting *pseudo-science* and bullshit that I offer what the Crossroads Conference organizers asked for in this paper: 1) A notable *success* in science education over the past few decades and 2) Some *vexing* aspect of science education and possible solutions.

A Success in Science Education

Recognizing the importance of teaching about the *nature of science* (NOS) as a normal part of science education has been a notable success since *Science for All Americans* appeared in 1989. The first chapter of that book is devoted to a description of the scientific worldview, scientific inquiry, and the scientific enterprise and it served as a guide to *Benchmarks for Science Literacy* and *National Science Education Standards*. Both *Benchmarks* and *Standards* were successful in getting States and professional societies to pay attention to the importance of developing a coherent science education program that includes NOS information and activities as well as key facts and theories that make up the knowledge base of science.

A big part of the reason that NOS has become an integral part of the science education curriculum and related teacher education programs is that the scientific community was behind the push for clearly articulated standards or benchmarks. The American Association for the Advancement of Science (AAAS) and the National Academy of Sciences (NAS) were solidly behind *Benchmarks* and *Standards* as scientists, educators, and others worked together to produce these important documents. The lesson of wide cooperation among scientists, educators, and others should not be lost in future efforts to improve science

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education. In the remainder of this brief paper I want to focus on an aspect of NOS that I believe was neglected in the transition from *Science for All Americans* to *Benchmarks and Standards* and it is reflected in the words following Science in the title of this paper.

A Vexation

The authors of *Benchmarks* and *Standards* seem to have assumed that the person who becomes scientifically literate will automatically be able to recognize “pseudo-science and just plain bullshit (JPB).” However, the knowledge needed to qualify one to be labeled ‘scientifically literate’ does not necessarily include the knowledge and habits of mind needed to detect pseudo-science and JPB. If a student acquires the requisite knowledge in astronomy, for example, to be considered scientifically literate but fails to recognize astrology as pseudo-science, that person has fallen short of the mark. If a student acquires the requisite knowledge in chemistry to be considered scientifically literate but fails to recognize alchemy as pseudo-science, that person has fallen short of the mark. And if a student acquires the requisite knowledge in biology to be considered scientifically literate but fails to recognize creation science/intelligent design as religion, that person has fallen short of the mark. If one takes seriously the Habits of Mind chapter in *Science for All Americans* it is not possible to use the label ‘scientifically literate’ for the alchemist or the astrologer or the creationist. To truly possess scientific habits of mind means one must be able and willing to detect pseudo-science and JPB.

My examples of alchemy and astrology are not likely to find much opposition but creation science is a lightning rod in today’s society, at least in the U.S. However, if we turn back the clock a few centuries alchemy and astrology and witches and magic were considered a part of everyday life, including religious practice. Pseudo-science and JPB vary greatly over time and space. Creation science has morphed into intelligent design and both represent the antithesis of scientific habits of mind, but many believers continue to try hard to include their religious beliefs in public school science curricula. They either cannot or will not distinguish between ‘science’ and ‘pseudo-science and JPB.’ By any reasonable standard or benchmark, they cannot be considered scientifically literate.

During May of this year there was an interesting discussion on the NARST listserv related to the issue of how a science teacher should deal with student questions of religious belief that enter into the domain of science. There was no consensus but many seemed to favor some kind of discussion, not debate, with students about the nature of science. I agree but I think the issue should not be limited to religious belief. Common examples of pseudo-science and JPB should be included as well. Just what these examples should be and how the teaching should be structured needs to be determined through extensive discussion among stakeholders in science education and investigations in classrooms. It is not only reasonable it is necessary that science literacy include the ability to detect pseudo-science and JPB that is so common in today’s society. Tomorrow’s science curriculum is likely to include a greater emphasis on human behavioral genetics, for example, as we learn more about the interaction of the environment and the human genome. The BSCS document *Genes, Environment, and Human Behavior* (2000) is an indication that this change is underway and it is reasonable to assume that social studies issues will merge with natural science issues, encouraging collaboration between science and social studies teachers. The biology of religious belief will very likely merge with social issues usually dealt with in social studies classes, requiring changes in how we view curriculum and instruction at the secondary levels of public education.

Our understanding of scientific literacy will change as our knowledge base in science, especially the life sciences, changes. The message in E.O. Wilson’s *Consilience* (1998) is that stable knowledge, based on reason and evidence, is best represented by the natural sciences and knowledge in the social sciences should build on this stable knowledge base. Pseudo-science and JPB that has long been a part of the social sciences will decrease as progress is made toward a stable knowledge base; that is, when these fields (anthropology, psychology, sociology, and so on) build on the natural sciences. As this happens science education and related research will reflect these changes in psychology, sociology, and so on toward scientifically-based knowledge. Trying to understand why so many people in today’s society accept pseudo-science and JPB should be an important part of any science education agenda in the 21st century.